



Reliable, Low Cost Distributed Generator/Utility System Interconnect

Subcontract Number: NAD-1-30605-01

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Electric Distribution Transformation Program

**2004 Annual Program and Peer Review Meeting
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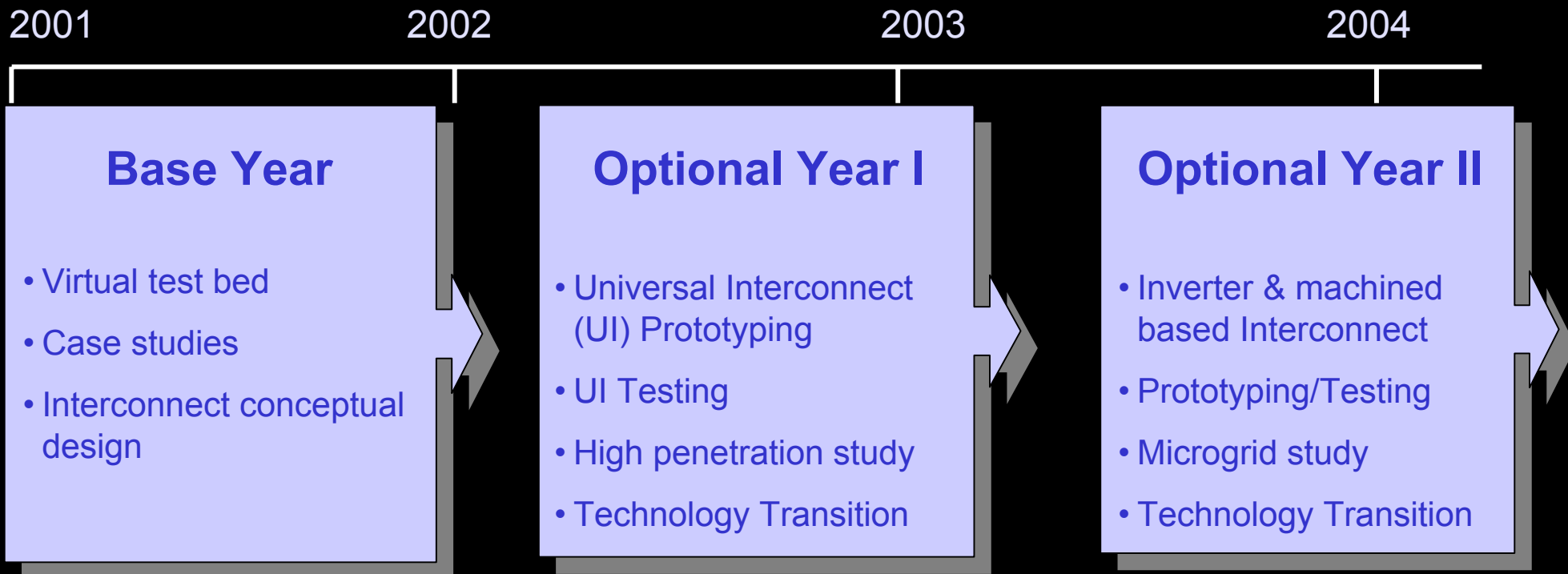
Outline

- **Program Overview**
 - Objectives, Three-Year Milestones & Budget
 - Relevance to Problems and Needs
 - Accomplishment Highlights
- **Detailed Accomplishments**
 - Technical Approach
 - Interconnect Study
 - Interconnect Design/Prototyping/Testing
- **Collaborations/Technology Transition**
- **Future Plans**

Program Overview

Objectives:

- Explore DG/Grid interconnection and system integration issues
- Develop standard-compliant DG/Grid interconnect to overcome interconnection barriers, to allow reliable system operation, and to achieve full value of DG



FUNDING

DOE (60%)	\$510K	\$500K	\$330K
GE (40%)	\$340K	\$385K	\$220K
Total (\$2,285K)	\$850K	\$885K	\$550K

Relevance to Problems and Needs*

*Proceedings of "National Electric Delivery Technologies Roadmap Workshop", July 8-9, 2003, Washington DC

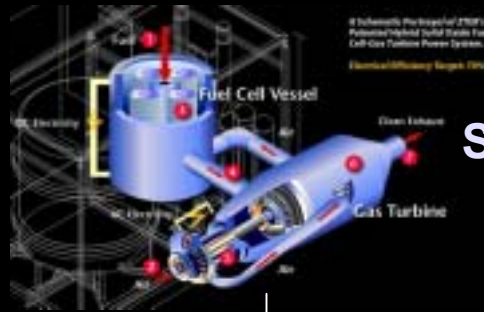


- GE's system simulation capabilities provide fundamental understanding of DG impact on power systems, as well as underlying design requirements for DG integration with power systems
- GE Proposed UI approach will reduce interconnection costs, both hardware and process, and allow for increased reliability and full value of DG without compromising system performance

GE Stakeholders



PV



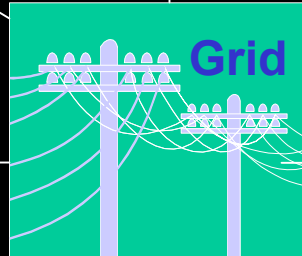
SOFC



μT



Wind



Grid



FC



Recip

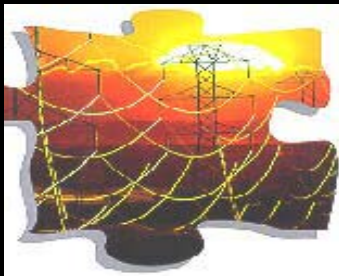
The technology is a key to the overall success of GE's strategy to move into the alternative energy and DG market

Teaming



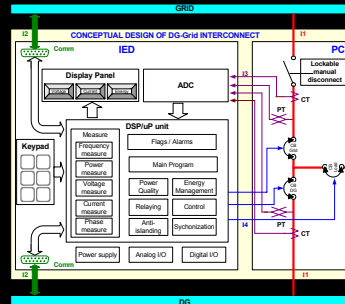
**GE
Global Research**

- specs/standards
- algorithms
- testing



**GE
Power System**

- specs
/standards
- application
- case studies



- Utility data
- consulting



Utility

- IED/PCD
- controls



**GE
Industrial Systems**

Cross GE Businesses/Utility Team

Program Accomplishments

- Delivered **10** milestones reports
- Published **6** papers, including 1 for workshop, 5 for IEEE Conferences
- Organized and chaired **1** DG panel session at IEEE Conferences
- Disclosed **5** inventions, including 2 filed for full patent
- Prototyped **2** interconnect hardware
- Technology transition to **2** GE product platforms

Significant achievements with visible business/industry impact

Technical Approach

Technical Challenges of Current Practices:

- System impact caused by DG/Grid interconnection is not well understood (quantitatively)
- No standard interconnection solutions that are well established and accepted
 - *Lack of low cost, reliable interconnection devices for DE and storage**
 - *Design of acceptable “black box” for DG interconnection**
 - *Simple, low cost utility pre-approved interconnect device**

Technical Approaches:

- **Modeling (VTB): not only understand fundamental issues, but quantitative analysis to provide system design guidelines**
- **Design and prototype new concepts/architectures/functions/controls to meet underlying requirements, universal solutions for plug-and-play and streamline process**
- **Testing: proof-of-concept and technology transition**

A system approach to addressing DG/Grid interconnection

Virtual Test Bed

	PSLF	Saber/ PSCAD
Grid	Reduced order Large scale	Reduced order Equivalent
DG	Average level Behavior level	Average level Switching level
	System level issues	Unit level issues

Fairwood Feeder

Fuel Cell DG

WECC

• DG/Load/Grid models
• Case studies
• Design evaluations

- ## A platform for long term DG & interconnect study